FINAL REPORT

Investigations to Determine the Effect of Maturity Groups, Silking-to-Denting Ripening Span, and Planting Rate on the Cost of Production, Yield, and Feeding Value of New Strains of Hybrid Corn for Silages

A complete report of research conducted under Contract No. 12-14-100-7752(44) with the Agricultural Research Service U. S. Department of Agriculture

Prepared by:
N.A. Clark, Assoc. Professor
Department of Agronomy
and
R.W. Hemken, Professor
Department of Dairy Science
University of Maryland
College Park

Submitted to:
The Contracting Officers' Designated Representative,
Dr. Chester H. Gordon, Research Dairy Husbandman
Dairy Cattle Research Branch
Animal Husbandry Research Division
Beltsville, Maryland

Date Prepared: June, 1969

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INTRODUCTION

Corn is the major silage crop in this country, amounting to over 60 million tons annually. Its popularity is to be expected since on many land areas this crop produces the greatest amount of feed energy per acre at the lowest cost per unit, and is well adapted to ensiling. Perhaps because relatively high yields of good corn silage have been routinely obtained, not enough attention has been given in the past to the possibility of improving yields and quality through changes in management technique.

Many workers have established that higher dry matter yields are obtained when the corn is allowed to approach maturity (1,2,3,4,5,6,9) than when it is harvested at an earlier stage.

Gunn (3) has shown that different maturity classes have unique moisture loss and dry matter accumulation profiles. Pendleton and Egi (8) found that corn planted in mid-to late May gave reduced yields over that planted in late April. Earlier plantings, however, did not yield higher than the late April planting. Nevens et al (7) showed a relationship between the dry matter content of corn forage and the ear content of the silage. Brown (1) states that the most common reason for low silage yields is too few plants per unit area.

An experiment was conducted from 1964 through 1967 to study the effect of corn hybrid maturity groups, silk to dent ripening spans, ear to stalk ratios, and planting rates on the yield and feeding value of corn silage. The study was established at the University of Maryland Agronomy-Dairy Forage Research Farm, Clarksville, Maryland on an Elsinboro silt loam which had a pH of 6.3 and tested medium in Mg, P, and K at the start of the ~~experiment~~.

1964 Study

METHODS AND MATERIALS

Twelve hybrids were planted on May 28 in a split plot design with four replications. Whole plots consisted of two planting rates and subplots were the varieties. A plot was four 40-inch rows, 40-feet long. The varieties were both closed and open pedigree hybrids, and were selected to represent a range from early to late season in piedmont Maryland. Fertilizer was plowed down at the rate of 133-90-90, and

33-33-33 was applied in the planter. An attempt was made to obtain a high population of 18,000 plants per acre and a low populatón of 12,000. However, due to variation in seed size among varieties and the inaccuracy of the planter, the actual populations varied considerably from this goal (table 1). Dates at which 50% of the plants of each variety were showing silks were recorded. Ten-plant samples were taken at approximately 10-day intervals beginning in early to mid-August when the total dry matter was less than 20% and continuing until late October. The ears with the husks were removed from the plants so that separate weights on these parts could be obtained. Both green and dry weights were determined on all samples. One row per plot was allowed to mature and was harvested as grain.

Three of the varieties used in the small plot study were planted in large blocks to be ensiled and later fed to steers. The ones selected represented an early (Pa 602A), medium (Todd 635), and late (NE 912) variety. The early and late varieties were planted at rates which provided populations 11,500 and 16,000 plants per acre, while the Todd 635 was at an intermediate population of 13,500. Row width was 40 inches and the planting date was May 26. Plots were approximately two acres with two replications. They were located on a Manor silt loam with a pH of 6.3 and testing medium in N,P, and K. Fertilizer was applied at the same rate and in the same manner as in the small plot study. The Pa 602A and the NE 912 were harvested and ensiled at approximately 25 and 35% dry matter by randomly selecting one half of each plot for early and late harvest. The Todd 635 was harvested at 31% dry matter. The center two rows in each plot were allowed to mature and were harvested as grain.

RESULTS AND DISCUSSION

The date at which 50% of the silks had emerged on each of the hybrids in the experiment was recorded (Table 2). These data were collected to determine differences in the ripening characteristics of the varieties being tested. While there was a spread of eight days in silk emergence among the hybrids tested, there was a spread of seventeen days in the dates at which the varieties reached 30% total dry matter. The order in which

the plants reached 30% dry matter was different from the silking order thus showing a variability in ripening time for the varieties being tested. The shortest and the longest periods were for two varieties which silked at the same time. The span for Todd 635 was August 2 to September 9 while the span for N.J. 9 was August 2 to September 19 (Table 3). The data in table 3 show the dry matter percentages and weights of ears and stover of the twelve varieties tested. While trends in dry matter accumulation by variety and by plant population are evident, the variability among the randomly selected 10-plant samples was too great to allow statistically significant differences to be shown. The data on dry matter percentages appeared to be the most reliable with the samples showing steadily increasing percentages of dry matter throughout the sampling period. Periods of rainy weather, however, did interfere with the accuracy of dry matter determinations. No trends were seen in the influence of plant population on dry matter percent of the plants. In some varieties the high plant population had a depressing effect on the size of the ear. This was true of N.J. 9, Todd 635, Munsee, Eastern States 830 and 800, Pioneer 312A, and Funk G 702. There was also a trend for reduced stover weights in most varieties when the dry matter content became higher than 50%. The data in table 3 show that the varieties selected for the feeding work in this study were representative of the early ripening varieties (Pa 602), the middle group (Todd 635), and the late ripening group (NE 912).

The data from the large blocks which were ensiled for the feeding study are shown in tables 4 and 5. Earlier harvested silage was higher in fresh weight and lower in dry weight than later harvested material. The dry matter yield of NE 912 harvested late was somewhat higher than that of other treatments, but otherwise no significant differences were noted. The grain yields presented in table 5 show no significant differences between treatments.

TABLE 1. Small plot study plant populations - 1964

	Variety	Low Population	High Population
		Plants/A	Plants/A
1.	Pa 602	12,051	16,480
2.	Ohio W 64	____1/	17,940
3.	V.P.I. 426	12,486	15,536
4.	Pioneer 345A	13,866	18,854
5.	N.J. 9	11,262	15,826
6.	Todd 635	10,817	16,116
7.	S.S. Munsee	16,303	20,784
8.	E.S. 830	15,183	19,746
9.	E.S. 800	15,826	20,835
10.	Pioneer 312A	13,358	17,423
11.	Funk G 702	15,173	18,357
12.	NE 912	11,180	____1/

1/ These treatments missing due to malfunction of the planter.

TABLE 2
Silking dates (50% of silks emerged) for corn varieties - 1964

	Variety	Low Population	High Population
1.	Pa 602	July 28	July 28
2.	Ohio W 64	______	July 29
3.	V.P.I. 426	July 30	July 31
4.	Pioneer 345A	July 31	August 1
5.	N.J. 9	August 2	August 1
6.	Todd 635	August 2	August 2
7.	S.S. Munsee	August 2	August 3
8.	E.S. 830	August 3	August 3
9.	E.S. 800	August 3	August 4
10.	Pioneer 312A	August 3	August 4
11.	Funk G 702	August 6	August 5
12.	NE 912	August 5	______

TABLE 3. Dry matter percentage and ear and stover weight from periodic sampling of silage varieties at two populations 1964.

Date	Low Population: Whole Plant Dry Matter	Low Population: Dry Weight-Single Plant: Ear	Stover	Whole Plant	High Population: Whole Plant Dry Matter	High Population: Dry Weight-Single Plant: Ear	Stover	Whole Plant
	%	g.	g.	g.	%	g.	g.	g.
		Pa 602				Pa 602		
8/7	14	45	195	241	13	41	168	209
8/17	18	114	177	291	17	77	150	227
8/27	24	182	186	368	26	132	186	318
9/6	31	250	168	418	28	191	209	400
9/16	38	300	177	477	44	209	123	331
9/26	46	286	177	463	43	241	150	390
10/26	56	281	195	477	56	236	91	327
		Ohio W 64				Ohio W 64		
8/7					16	36	136	173
8/17					19	77	154	232
8/27					25	123	145	268
9/6					27	159	132	291
9/16					45	209	132	341
9/26					46	222	141	363
10/26					62	227	95	322
		VPI 426				VPI 426		
8/8	14	41	182	222	13	36	154	191
8/20	18	118	222	341	18	109	173	281
8/29	24	182	241	422	22	141	168	309
9/7	29	191	200	390	31	200	150	350
9/17	41	281	286	568	40	309	259	568
10/1	38	363	204	568	36	331	209	540
10/27	61	331	123	454	51	281	145	426

TABLE 3
(contd)

		Pioneer 345A				Pioneer 345A		
8/8	14	45	227	272	13	36	154	191
8/20	17	141	291	431	21	91	200	291
8/30	22	150	168	318	27	132	236	368
9/8	27	318	291	608	36	109	272	381
9/18	43	259	227	486	35	250	168	418
10/1	37	222	168	390	37	263	132	395
10/27	63	304	118	422	53	241	95	336
		N.J. 9				N.J. 9		
8/10	11	50	182	232	13	45	182	227
8/21	15	132	309	440	18	100	259	359
8/31	14	209	259	468	22	182	236	418
9/9	27	241	309	549	18	218	191	409
9/19	30	381	295	676	35	182	177	359
10/2	37	359	272	631	37	213	163	377
10/28	58	381	236	617	53	182	127	309
		Todd 635				Todd 635		
8/11	16	82	227	309	14	41	209	249
8/21	22	118	259	377	17	91	209	300
8/31	21	182	250	431	18	118	218	336
9/9	30	281	218	499	29	259	268	499
9/19	38	291	236	527	38	241	159	400
10/2	33	313	254	568	44	222	191	413
10/27	49	345	291	636	60	222	100	322
		Southern States Munsee				Southern States Munsee		
8/11	15	50	150	200	14	41	163	204
8/21	27	109	222	331	17	68	150	218
8/31	21	91	186	277	19	82	136	218
9/9	28	168	173	341	29	200	141	341
9/19	31	281	195	477	41	150	118	268
10/2	37	300	204	504	41	136	104	241
10/27	55	359	154	513	56	136	100	236

TABLE 3
(contd)

	Eastern States 830				Eastern States 830			
8/12	16	45	177	222	16	41	168	209
8/22	21	100	218	318	23	82	186	268
9/2	25	150	177	327	26	91	136	227
9/12	31	241	209	449	40	150	150	300
9/22	33	259	173	431	50	141	127	268
10/6	39	245	132	377	43	123	118	241
10/26	54	322	159	481	60	236	118	354
	Eastern States 800				Eastern States 800			
8/12	14	41	163	204	18	32	150	182
8/23	21	118	232	350	23	68	159	227
9/2	21	168	222	390	30	82	127	209
9/12	29	218	204	422	35	168	114	281
9/22	33	259	173	431	35	91	150	241
10/6	39	304	127	431	41	150	141	291
10/28	61	254	132	386	63	154	118	272
	Pioneer 312A				Pioneer 312A			
8/12	13	36	191	227	16	45	168	213
8/23	21	132	268	400	22	68	218	286
9/3	22	168	268	436	23	100	168	286
9/13	30	241	218	459	34	159	150	309
9/23	35	259	191	449	36	182	150	331
10/6	42	295	154	449	43	150	141	291
10/28	65	277	145	422	61	236	141	377
	Funk G-702				Funk G-702			
8/14	17	41	150	191	17	41	150	191
8/25	20	100	209	309	24	68	209	277
9/3	23	168	200	368	26	100	150	250
9/13	30	259	227	486	38	150	150	300
9/23	42	218	173	390	41	141	118	259
10/7	45	222	132	354	49	145	127	272
10/29	60	281	145	427	55	200	200	400

TABLE 3
(contd)

NE 912

8/15	16	68	259	327
8/25	20	118	309	427
9/4	23	168	263	431
9/13	32	241	236	477
9/23	45	281	245	527
10/6	47	277	318	595
10/28	52	341	222	563

TABLE 4. Silage yields from three varieties and three populations, harvested at three dry matter levels - 1964

Variety	Population	Dry Matter	Fresh Weight	Dry Weight	Harvest Date
	Plants/A	%	T/A	T/A	
Pa 602	11,500	23.0	19.6	4.5	Aug. 26
Pa 602	16,000	24.9	19.7	4.9	Aug. 26
Pa 602	11,500	35.7	16.0	5.7	Sept. 10
Pa 602	16,000	36.7	14.7	5.4	Sept. 10
Todd 635 (check)	13,500	31.0	16.8	5.2	Sept. 8
NE 912	11,500	25.3	19.8	5.0	Sept. 4
NE 912	16,000	25.1	21.1	5.3	Sept. 4
NE 912	11,500	34.5	16.2	5.6	Sept. 15
NE 912	16,000	34.6	17.9	6.2	Sept. 15

TABLE 5. Grain yield from large blocks - 1964

Variety	Population	Yield
	Plants/A	Bu/A
Pa 602	11,500	90
Pa 602	16,000	87
Todd 635 (check)	13,500	88
NE 912	11,500	89
NE 912	16,000	82

1965 Study

METHODS AND MATERIALS

The experiment was continued in 1965 essentially the same as in 1964, but with some substitution in the small plot varieties. The planting date was May 20, almost a week earlier than in 1964, but the harvest dates for the corn ensiled for the feeding study was approximatley two weeks later than in 1964.

RESULTS AND DISCUSSION

Planting rates for the small plot study are shown in table 6. An attempt was made to raise the planting rates over the 1964 rates, but again there was some variability in plant stands. The greatest deviation from the average seeding rates of 1964 and 1965 was with DeKalb XL45. This variety was recommended by the DeKalb Agricultural Association, Inc. to be seeded at rates approaching 30,000 plants per acre. Data on successive harvests of 10-plant samples from the small plots during the period of ear maturity are shown in table 7. Again, the sampling technique with 10-plant random samples showed considerable variability, however, several trends were evident. While in 1964, sampling was begun while plants were in the 20% dry matter range, in 1965 the early sampling was with the plants in the 30% range. The data show that dry matter of both ear and stover is maximized when the plant achieves approximately 35% dry matter, and under the weather conditions of 1965 some stover loss occured with most varieties as dry matter reached the 50-60% range. Some of the varieties selected for testing in 1965 showed a greater range in ear-stalk ratio than those planted the previous year. Notable among these was DeKalb XL45 in which the ear comprised over half the total plant weight and Pioneer 1097 in which the ear was less than half the total weight. The data also show that high planting rates tend to reduce ear size in varieties like DeKalb 805, but do not affect ear-stalk ratios in varieties like XL45.

Data in tables 8 and 9 show silage and grain yields for the large blocks which were ensiled for the feeding trials. The more mature

silage had lower fresh weight and higher dry weight than the early cut silage. The long season corn (NE 912) outyielded the short season Pa 602 variety. Drought conditions prevailed over much of the growing season and this was reflected in lower yields of grain and silage than would be expected under more favorable rainfall conditions. Grain production in the high population NE 912 suffered because of the dry weather and yields were significantly lower than in the low populations (86.8 vs. 68.6 bu. per acre).

TABLE 6. Small plot study plant populations - 1965

	Variety	Low Population	High Population
		Plants/A	Plants/A
1.	Pa 602	14,800	20,850
2.	Ohio W-64	12,900	19,000
3.	V.P.I. 426	13,450	18,000
4.	Pioneer 345A	14,250	20,100
5.	Southern States 909E	14,650	19,550
6.	Todd 635	15,000	21,200
7.	Pioneer 309A	15,200	19,150
8.	Pioneer 1097	15,950	19,250
9.	DeKalb XL45	22,400	31,650
10.	DeKalb 805	12,900	20,000
11.	Pioneer 312A	14,450	20,200
12.	NE 912	12,800	17,800

TABLE 7. Dry matter percentage and ear and stover weight from periodic sampling of silage varieties at two populations-1965

	Low Population				High Population			
Date	Whole Plant Dry Matter	Dry Weight-Single Plant Ear	Stover	Whole Plant	Whole Plant Dry Matter	Dry Weight-Single Plant Ear	Stover	Whole Plant
	%	g.	g.	g.	%	g.	g.	g.
		Pa 602				Pa 602		
9/2	28	160	165	325	27	151	147	298
9/11	39	171	155	326	38	155	141	296
9/22	47	211	160	371	45	181	136	317
10/4	56	214	142	356	57	166	120	286
10/12	62	214	109	323	60	182	98	280
10/25	68	213	114	327	67	200	86	286
		Ohio W 64				Ohio W 64		
9/2	28	193	192	385	28	188	165	353
9/10	34	195	172	367	35	197	152	349
9/22	46	197	148	345	46	221	159	380
10/4	55	227	133	360	55	225	135	360
10/12	58	222	120	342	59	219	129	348
10/25	62	232	118	350	62	209	113	322
		VPI 426				VPI 426		
9/8	28	196	204	400	26	190	165	355
9/18	43	261	221	482	41	219	180	399
9/28	48	255	175	430	47	241	138	379
10/8	53	262	173	435	55	197	135	332
10/18	58	281	150	431	58	241	136	377
10/28	62	268	122	390	63	268	127	395

TABLE 7
(contd)

	Pioneer 345A				Pioneer 345A			
9/8	29	225	201	426	27	194	183	377
9/20	38	225	196	421	39	199	171	370
9/29	53	239	176	415	50	220	150	370
10/11	58	279	138	417	55	213	111	324
10/19	60	272	150	422	61	250	154	404
10/29	69	286	132	418	65	245	127	372
	Southern States 909E				Southern States 909E			
9/21	34	242	244	486	34	179	222	401
9/30	39	233	234	467	39	227	203	430
10/14	48	235	185	420	57	233	242	475
10/20	51	259	204	463	57	200	186	386
10/30	61	272	168	440	65	227	127	354
	Todd 635				Todd 635			
9/9	28	208	258	466	26	137	185	322
9/20	37	262	228	490	35	209	163	372
9/29	52	202	148	350	52	191	150	341
10/11	54	265	241	446	52	184	112	296
10/19	62	281	173	454	61	222	223	445
10/29	72	281	159	440	68	241	122	363
	Pioneer 309A				Pioneer 309A			
9/23	32	248	267	515	30	204	207	411
10/4	43	257	213	470	44	202	168	370
10/12	47	245	231	476	45	204	206	410
10/23	51	295	204	499	50	254	200	454

TABLE 7
(contd)

		Pioneer 1097				**Pioneer 1097**		
9/26	29	216	259	475	27	191	236	427
10/5	38	236	268	504	36	213	232	445
10/15	42	232	213	445	44	200	190	390
10/25	46	241	190	431	48	204	196	400
		DeKalb XL45				**DeKalb XL45**		
9/3	29	148	97	245	29	139	106	245
9/11	37	162	117	279	38	145	98	243
9/23	43	173	103	276	44	151	96	247
10/4	59	202	75	277	57	186	68	254
10/12	63	203	22	225	64	174	68	242
10/23	70	222	55	277	68	168	54	222
		DeKalb 805				**DeKalb 805**		
9/8	31	257	245	502	33	175	180	355
9/18	41	285	231	516	40	222	174	396
9/28	51	266	204	470	53	197	163	360
10/8	55	347	161	508	56	195	146	341
10/19	60	286	191	477	61	186	164	350
10/28	71	291	140	431	70	263	91	354
		Pioneer 312A				**Pioneer 312A**		
9/16	31	252	241	493	31	189	176	365
9/26	39	263	244	507	44	227	203	430
10/5	48	291	181	472	51	222	155	377
10/15	53	318	204	522	53	259	195	454
10/25	63	286	182	468	63	259	136	395

TABLE 7
(contd)

		NE 912				NE 912		
9/20	32	216	241	457	34	225	193	418
9/30	37	295	283	578	39	215	177	392
10/14	48	301	239	540	47	236	184	420
10/20	52	300	213	513	50	254	195	449
10/30	63	313	195	508	64	259	168	427

TABLE 8. Silage yields from three varieties and three populations, harvested at three dry matter levels -1965

Variety	Population	Dry Matter	Fresh Weight	Dry Weight	Harvest Date
	Plants/A	%	T/A	T/A	
Pa 602	17,200	28.1	16.7	4.7	September 7
Pa 602	21,000	27.8	18.7	5.2	September 3
Pa 602	17,200	44.6	10.8	4.8	September 23
Pa 602	21,000	45.0	12.2	5.5	September 22
Todd 635 (check)	18,400	40.0	15.2	6.1	September 24
NE 912	14,650	33.2	21.4	7.1	September 21
NE 912	18,180	31.0	19.0	5.9	September 20
NE 912	14,650	43.2	14.8	6.4	October 13
NE 912	18,180	47.8	15.7	7.5	October 11

TABLE 9. Grain yield from large blocks -1965

Variety	Population	Yield
	Plants/A	Bu/A
Pa 602	17,200	61.1
Pa 602	21,000	67.8
Todd 635 (check)	18,400	78.8
NE 912	14,650	86.8
NE 912	18,180	68.6

1966 Study

METHODS AND MATERIALS

The 1966 experiment was established using the same small plot and large block areas of the previous years. The planting date was June 1. Some substitutions were made in the small plot varieties, while in the large blocks planted for use in the feeding studies, the varieties Pioneer 1097 and DeKalb XL45 were used to replace the three varieties used previously. A high and a low planting rate were used in the small plots. The Pioneer 1097 was planted at a low and a high rate in the large blocks while the DeKalb XL45 was planted at a single rate.

RESULTS AND DISCUSSION

Planting rates for the small plot study are shown in table 10. The varieties Pioneer 3304, DeKalb XL45, and PAG SX29 were adapted to higher plant populations than the other varieties, thus higher planting rates were selected for these. Data on successive harvests of 10-plant smaples from the small plots are shown in table 11. In 1966 the dry matter percentages of the ear and stover components were obtained separately. These figures are presented along with the dry matter percentages of the whole plant samples. The samples span the period when total dry matter ranged from 20 to 50 percent. Ear-stover ratios are also presented in this table in an attempt to characterize differences between varieties and plant populations in the relative weights of the ears and stover. The variety Pioneer 1097 showed a higher proportion of stover to ear than did DeKalb XL45. This was accentuated by the high plant population in Pioneer 1097 while the high population had no effect on ear-stover ratio in DeKalb XL45. These varieties had been selected for study in the feeding trial based on differences in ear-stover ratios observed in the small plots in 1965.

Silage yields from the large blocks ensiled for feeding are shown in table 12. Little differences in dry weight were obtained among the treatments. An attempt was made to harvest the silage at 25 and 45%

dry matter, but both these values were missed for most of the treatments. Harvest dates for the low moisture Pioneer 1097 were 19 days apart while the dry matter did not reach 25% for either plant population. The reason for the spread in time is that almost 7 inches of rain fell between September 7 and 26, with 6 inches occurring on September 14. This heavy rainfall caused a delay in dry matter accumulation in the low population Pioneer 1097. Both populations of Pioneer 1097 were harvested on November 7, and at this date the low population had reached 45% dry matter, but the high population was only at 36.8%. This condition was due to the fact that the wind and rain which occurred on September 14 caused extensive lodging in the high population Pioneer 1097, and the badly lodged corn did not dry as much as did the upright low-population corn.

TABLE 10. Small plot study plant populations - 1966

Variety	Low Population	High Population
	Plants/A	Plants/A
1. NK PX 674 MF	20,000	37,700
2. NK PX 52	19,100	35,100
3. Pioneer 3304*	31,200	44,240
4. Pioneer 1097	19,600	35,600
5. Funk G 711 AA	20,000	35,090
6. Asgrow SM 6	20,900	36,200
7. DeKalb 805	19,200	37,000
8. Dekalb 385	20,400	35,200
9. DeKalb XL 45*	30,100	45,500
10. PAG SX 29*	25,000	40,000
11. NE 912	20,200	31,300
12. Todd 635	21,100	37,300

* Varieties adapted to high plant populations

TABLE 11. Dry matter percentage and ear and stover weight from periodic sampling of silage of silage varieties at two populations-1966

Date	Dry Matter			Dry Weight-Single Plant			Ear-Stover
	Ear	Stover	Total	Ear	Stover	Total	Ratio
	%	%	%	g	g	g	
NK PX 674 MF - Low Population							
8/31	27.5	24.2	24.9	68	173	241	1 : 2.5
9/12	40.5	25.6	29.2	91	168	259	1 : 1.8
9/20	55.6	29.2	38.3	141	136	277	1 : 0.9
9/30	55.8	30.4	39.2	145	146	291	1 : 1.0
10/10	56.4	38.3	43.4	82	154	236	1 : 1.9
10/20	64.1	39.2	51.0	145	100	245	1 : 0.7
NK PX 674 MF - High Population							
8/31	23.8	24.4	24.2	27	127	154	1 : 4.7
9/12	38.1	24.3	27.1	41	100	141	1 : 2.4
9/20	52.6	31.1	36.1	86	123	209	1 : 1.4
9/30	51.8	32.0	42.1	91	95	186	1 : 1.0
10/10	64.4	38.9	46.5	64	90	154	1 : 1.4
10/20	58.6	46.3	49.5	50	95	145	1 : 1.9
NK PX 52 - Low Population							
8/23	25.0	20.7	22.0	123	240	363	1 : 2.0
9/6	42.9	28.7	33.0	118	159	277	1 : 1.3
9/19	53.8	23.4	35.1	168	123	291	1 : 0.7
9/22	62.3	31.2	44.2	173	54	227	1 : 0.3
10/2	67.0	32.4	47.4	163	100	263	1 : 0.6
10/12	69.2	33.8	50.4	159	86	245	1 : 0.5

TABLE 11
(contd)

NK PX 52 - High Population							
8/23	19.5	22.0	21.1	36	150	186	1 : 4.1
9/6	38.7	27.0	30.4	41	59	100	1 : 1.4
9/19	56.4	25.6	35.8	59	55	114	1 : 0.9
9/22	56.8	29.8	39.9	73	72	145	1 : 1.0
10/2	62.1	31.8	40.4	68	64	132	1 : 0.9
10/12	63.6	34.0	44.3	54	60	114	1 : 1.1
Pioneer 3304 - Low Population							
8/29	24.5	21.8	22.5	91	254	345	1 : 2.8
9/8	34.8	20.8	23.0	50	73	123	1 : 1.5
9/19	45.5	20.2	29.3	77	68	145	1 : 0.9
9/28	51.8	26.0	37.2	159	104	263	1 : 0.7
10/8	60.4	38.0	47.7	141	113	254	1 : 0.8
10/28	62.1	35.7	47.9	145	100	245	1 : 0.7
Pioneer 3304 - High Population							
8/29	20.8	22.0	21.8	32	136	168	1 : 4.2
9/8	29.9	22.6	27.4	59	68	127	1 : 1.2
9/19	43.8	21.3	26.6	54	82	136	1 : 1.5
9/28	54.4	31.6	41.5	59	64	123	1 : 1.1
10/8	55.9	35.1	45.1	36	59	95	1 : 1.6
10/28	59.2	40.7	48.2	64	59	123	1 : 0.9
Pioneer 1097 - Low Population							
9/6	29.9	22.8	24.1	59	191	250	1 : 3.2
9/18	40.2	19.2	22.8	95	50	145	1 : 0.5
9/23	51.1	23.9	31.5	159	195	354	1 : 1.2
10/3	53.5	24.6	33.2	182	168	350	1 : 0.9
10/13	58.7	28.0	39.7	182	140	322	1 : 0.8
11/7	63.1	39.9	48.4	182	163	345	1 : 0.9

TABLE 11
(contd)

Pioneer 1097 - High Population							
9/6	21.8	22.2	18.9	9	154	163	1 : 17.1
9/18	34.8	18.6	19.8	23	104	127	1 : 4.5
9/23	52.3	26.3	32.0	82	140	222	1 : 1.7
10/3	53.6	29.7	35.3	73	122	195	1 : 1.7
10/13	51.5	32.2	36.6	59	100	159	1 : 1.7
11/7	61.8	42.3	48.5	95	105	200	1 : 1.1
Funk G - 711 AA - Low Population							
9/6	29.2	26.3	26.9	59	186	245	1 : 3.2
9/18	39.6	21.9	28.0	95	100	295	1 : 1.1
9/23	52.4	26.1	31.5	127	159	286	1 : 1.3
10/3	56.1	30.2	39.7	132	163	295	1 : 1.2
10/13	60.8	33.1	43.6	132	113	245	1 : 0.9
11/7	62.4	35.5	49.6	154	127	281	1 : 0.8
Funk G - 711 AA - High Population							
9/6	26.2	23.7	24.0	41	145	186	1 : 3.5
9/18	36.5	22.2	25.4	54	173	227	1 : 3.2
9/23	53.4	26.1	30.1	109	109	218	1 : 1.0
10/3	59.7	38.0	45.2	91	118	209	1 : 1.3
10/13	55.5	33.5	41.4	104	114	218	1 : 1.1
11/7	61.6	39.5	49.1	118	4	222	1 : 0.3
Asgrow SM 6 - Low Population							
8/29	29.2	22.0	23.6	136	318	454	1 : 2.3
9/8	40.3	25.0	28.0	95	177	272	1 : 1.9
9/19	53.7	23.9	33.2	127	186	313	1 : 1.5
9/28	57.6	28.1	38.4	168	150	318	1 : 0.9
10/8	59.0	33.0	42.3	145	146	291	1 : 1.0
10/28	65.3	37.9	48.2	168	141	309	1 : 0.8

TABLE 11
(contd)

Asgrow SM 6 - High Population							
8/29	25.0	22.2	22.6	59	254	313	1 : 4.3
9/8	36.7	21.5	24.7	64	140	204	1 : 2.2
9/19	54.7	25.4	41.4	114	181	295	1 : 1.6
9/28	55.3	30.4	39.4	109	123	232	1 : 1.1
10/8	55.8	31.9	38.5	73	122	195	1 : 1.7
10/28	58.0	38.4	43.6	77	109	186	1 : 1.4
DeKalb 805 - Low Population							
8/31	26.3	11.9	17.2	41	144	155	1 : 3.5
9/12	41.0	22.5	26.6	82	140	222	1 : 1.7
9/20	55.2	30.6	38.5	127	150	277	1 : 1.2
9/30	54.7	28.3	40.4	163	100	263	1 : 0.6
10/10	60.5	32.3	41.6	114	122	236	1 : 1.1
10/20	69.4	39.1	53.0	159	100	259	1 : 0.6
DeKalb 805 - High Population							
8/31	24.2	21.0	17.8	23	77	100	1 : 3.3
9/12	39.0	23.9	26.6	41	113	154	1 : 2.8
9/20	53.5	28.2	34.8	73	100	173	1 : 1.4
9/30	45.0	27.8	31.1	45	109	154	1 : 2.4
10/10	49.4	32.9	37.8	45	118	163	1 : 2.6
10/20	63.7	39.5	49.5	95	78	173	1 : 0.8
DeKalb 385 - Low Population							
8/30	24.4	21.1	21.8	104	386	490	1 : 3.7
9/9	43.2	24.6	28.8	86	205	291	1 : 2.4
9/19	57.0	26.9	34.6	123	158	281	1 : 1.3
9/29	61.2	31.4	43.4	191	159	350	1 : 0.8
10/9	60.7	35.2	45.2	173	136	309	1 : 0.8
10/31	65.7	44.0	54.2	182	136	318	1 : 0.7

TABLE 11
(contd)

DeKalb 385 - High Population							
8/30	21.1	21.8	21.7	50	222	272	1 : 4.4
9/9	32.5	24.6	27.5	50	104	154	1 : 2.1
9/19	52.1	24.2	33.5	109	95	204	1 : 0.9
9/29	56.6	30.4	39.3	123	113	236	1 : 0.9
10/9	51.5	30.0	35.3	59	118	177	1 : 2.0
10/31	63.6	37.2	44.5	77	105	182	1 : 1.4
DeKalb XL 45 - Low Population							
8/23	23.6	21.1	22.2	68	182	250	1 : 2.7
9/6	39.2	25.1	29.5	77	96	173	1 : 1.2
9/19	52.2	23.5	33.8	127	95	222	1 : 0.7
9/22	59.2	25.7	33.8	141	50	191	1 : 0.4
10/2	60.2	32.8	46.5	123	77	200	1 : 0.6
10/12	67.2	34.3	49.0	145	77	222	1 : 0.5
DeKalb XL 45 - High Population							
8/23	21.8	19.5	19.0	54	155	209	1 : 2.9
9/6	40.7	23.4	28.0	50	82	132	1 : 1.6
9/19	51.4	25.1	32.7	77	73	150	1 : 0.9
9/22	55.4	28.8	40.1	100	63	163	1 : 0.6
10/2	66.0	33.8	48.6	104	64	168	1 : 0.6
10/12	67.2	40.4	50.6	77	68	145	1 : 0.9
PAG SX 29 - Low Population							
9/1	29.9	21.8	23.4	54	141	195	1 : 2.6
9/12	41.0	23.7	28.5	91	136	227	1 : 1.5
9/21	53.8	26.2	35.4	123	131	254	1 : 1.1
10/1	57.3	31.1	40.4	114	99	213	1 : 0.9
10/11	67.8	39.1	51.7	154	109	263	1 : 0.7
10/21	65.9	40.3	51.9	141	100	241	1 : 0.7

TABLE 11
(contd)

PAG SX 29 - High Population							
9/1	26.8	26.3	26.9	32	122	154	1 : 3.8
9/12	40.5	23.7	28.9	64	86	150	1 : 1.3
9/21	51.4	27.8	36.8	82	86	168	1 : 1.0
10/1	58.8	35.2	42.7	77	73	150	1 : 0.9
10/11	65.6	45.3	53.5	82	63	145	1 : 0.8
10/21	63.1	40.1	52.2	82	59	141	1 : 0.7
NE 912 - Low Population							
9/1	28.8	26.4	27.0	73	231	304	1 : 3.2
9/12	40.9	22.5	27.3	132	213	345	1 : 1.6
9/21	58.3	23.9	35.1	213	177	390	1 : 0.8
10/1	65.4	29.9	42.6	209	163	372	1 : 0.8
10/11	63.5	42.4	51.7	227	195	422	1 : 0.9
10/21	67.7	42.8	54.4	191	150	341	1 : 0.8
NE 912 - High Population							
9/1	21.9	23.6	22.6	14	104	118	1 : 7.4
9/12	40.0	26.8	30.3	64	90	154	1 : 1.4
9/21	50.8	26.5	35.7	68	77	145	1 : 1.1
10/1	56.3	29.5	37.5	59	82	141	1 : 1.4
10/11	52.3	32.2	39.5	109	18	127	1 : 1.7
10/21	62.1	38.0	47.3	73	63	136	1 : 0.9
Todd 635 - Low Population							
8/30	28.4	22.9	23.9	114	313	427	1 : 2.7
9/9	42.1	23.5	27.0	91	186	277	1 : 2.0
9/19	56.1	26.0	35.1	145	150	295	1 : 1.0
9/29	55.9	32.0	41.3	141	127	268	1 : 0.9
10/9	59.1	31.3	44.0	136	164	300	1 : 1.2
10/31	63.1	41.0	50.6	141	127	268	1 : 0.9

TABLE 11
(contd)

Todd 635 - High Population

8/30	22.2	23.2	22.9	36	196	232	1 : 5.4
9/9	37.2	25.6	29.2	59	91	150	1 : 1.5
9/19	51.0	30.5	36.3	73	86	159	1 : 1.2
9/29	48.5	30.4	35.5	45	82	127	1 : 1.8
10/9	57.7	29.4	33.9	36	87	123	1 : 2.4
10/31	61.8	38.3	45.6	64	90	154	1 : 1.4

TABLE 12. Silage yields of DeKalb XL 45 at a single population and Pioneer 1097 at two populations, both harvested at two dry matter levels - 1966

Variety	Plant Population	Dry Matter	Fresh Weight	Dry Weight	Harvest Date
	Plants/A	%	T/A	T/A	
DeKalb XL 45	37,000	26.4	14.5	3.8	September 2
Pioneer 1097	21,200	22.1	15.0	3.3	September 26
Pioneer 1097	43,900	20.5	15.8	3.3	September 7
DeKalb XL 45	37,000	49.4	6.0	3.0	October 24
Pioneer 1097	21,200	45.0	7.7	3.5	November 7
Pioneer 1097	43,900	36.8	7.8	2.9	November 7

1967 Study

METHODS AND MATERIALS

Both the small plot study and the large block experiment for the feeding work was revamped in 1967. Only two varieties, DeKalb XL 45 and Pioneer 1097, were seeded in the small plots. These two varieties represented the greatest extremes in plant morphology and ear-stover ratio of all varieties tested in previous years. The same plot area from the previous years was used in 1967 with the same size plots. The two varieties were randomly assigned, six plots each per replication in four replications. Six harvest dates approximately 10 days apart were assigned for each variety. This allowed 2 rows 30-feet long to be harvested from each replication on each date rather than the 10-plant sampling which had been conducted in previous years. It was felt that the variability experienced with the 10-plant samples could be reduced by obtaining a larger sample. The planting date was May 5 and the theoretical planting rates were 25,000 plants per acre for the Pioneer 1097 and 30,000 for the DeKalb XL 45. The actual populations achieved were 25,400 for Pioneer 1097 and 31,700 for DeKalb XL 45.

The large blocks were also planted on May 5 at the same planting rates as the small plots. The large blocks were harvested as four treatments for the feeding study: DeKalb XL 45 as whole plant silage and stover silage and Pioneer 1097 as whole plant silage and stover silage. Harvest dates in the large blocks were September 15 for the DeKalb and October 13 for the Pioneer.

RESULTS AND DISCUSSION

Data from periodic sampling are shown in table 13. Yields in tons per acre are quite comparable for the two varieties, but the ear weights produced by the DeKalb XL 45 are considerably higher than for the Pioneer 1097. There was some loss in stover dry matter at the latest harvest, although there was still variability in the data dispite the fact that larger samples were taken in 1967 than in previous years. The large blocks (Table 14) produced equal total dry matter yields for both varieties, and these were also equal to the yields for both

TABLE 13. Dry matter percentage and ear and stover weight from periodic sampling of two silage varieties - 1967

Date	Dry Matter			Dry Weight Yield			Ear-Stover Ratio
	Ear	Stover	Total	Ear	Stover	Total	
	%	%	%	T/A	T/A	T/A	
				DeKalb XL 45			
8/29	44.5	17.8	24.4	3.4	3.4	6.8	1 : 1.0
9/8	52.4	22.1	33.1	4.9	3.5	8.4	1 : 0.7
9/18	52.1	25.4	35.5	3.9	3.2	7.1	1 : 0.8
9/28	63.0	36.5	47.7	4.6	3.7	8.3	1 : 0.8
10/9	67.3	35.2	49.9	4.8	3.0	7.8	1 : 0.6
10/24	69.6	36.1	52.5	4.6	2.5	7.1	1 : 0.5
				Pioneer 1097			
9/11	41.8	21.8	25.1	2.0	5.3	7.3	1 : 2.7
9/21	45.4	19.6	24.2	2.5	4.8	7.3	1 : 1.9
10/3	52.6	23.4	29.0	2.8	5.2	8.0	1 : 1.9
10/13	54.9	23.6	30.9	3.1	4.3	7.4	1 : 1.4
11/6	62.3	32.3	40.2	2.8	4.1	6.9	1 : 1.5

TABLE 14. Yield and dry matter percentage of whole plant silage, stover silage, and ears of two corn varieties - 1967

Variety	Treatment	Dry Matter	Yield	
			Fresh Weight	Dry Weight
		%	T/A	T/A
DeKalb XL 45	Whole Plant	35.3	21.2	7.5
DeKalb XL 45	Stover	21.5	11.2	2.4
DeKalb XL 45	Ears	54.7	9.0	4.9
Pioneer 1097	Whole Plant	29.7	24.5	7.3
Pioneer 1097	Stover	21.6	16.2	3.4
Pioneer 1097	Ears	53.6	8.0	4.3

varieties, and these were also equal to the yields produced in the small plots for comparable dates. Ear weights between varieties over the two experimental areas varied, however, and this could be attributed to soil differences. The Manor soil on which the large blocks were located was a much better drained soil than the Elsinboro on which the small plots were located. Rainfall was abundant in 1967 and the poor drainage in the small plot area was detrimental to optimum ear development. In dry years the Elsinboro soil was superior in corn production, but the conditions in 1967 favored production on the Manor soil.

GENERAL SUMMARY

Many of the commonly grown hybrids were evaluated over four years as silage corn. These represented open and closed pedigree hybrids and maturity groups from early through late for the Maryland area. Varieties which tolerated heavy planting rates and which had a high ear to stover ratio were compared with taller growing varieties which had a low ear to stover ratio. The study showed that the significant features which characterize a good silage variety are:

1. The ability of a variety to produce high yields of TDN. This means that high yields of grain as well as stover are important. In some cases the highest yielding variety would not be the best choice for silage, as a lower yielding hybrid with a greater grain yield might produce more TDN per acre.
2. A growth span which allows the corn to mature and reach a total dry matter of 35% or more before the killing frost. This permits the greatest accumulation of dry matter per acre.
3. The ability to resist lodging even at high levels of fertility and heavy planting rates.

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INTAKE AND DIGESTIBILITY OF CORN SILAGES OF DIFFERENT MATURITIES, VARIETIES AND PLANT POPULATIONS

H. K. Goering, R. W. Hemken

N. A. Clark and J. H. Vandersall

University of Maryland,

College Park

The feeding of corn silage has long been a common practice in corn producing areas, however, the effect of cultural practices on nutritive value has received only minor attention. Some important factors are: stage of maturity (Huber, _et al_., 1965), varieties (White _et al_., 1924), plant population (Nevens, 1951; Alexander, _et al_., 1963) and soil fertility (Alexander, _et al_., 1963). Since many of these studies were conducted with only one variable at a time, it is difficult to evaluate possible interactions. In addition, management practices in use today include a much wider range among the variables than those studied previously.

The purpose of these experiments was to estimate the nutritive value of corn silage harvested at several stages of maturity or moisture contents, at different plant populations per hectare and with varieties which differ in date of maturity (based on length of growing season needed for complete growth and ripening).

Experimental

Experiment I.

Silages. Eight treatment combinations were obtained by a 2X2X2 factorial design of high and low plant population, low and high dry matter content, and early and late maturing varieties. Hybrid varieties representing early and late maturing were Pennsylvania (Pa.) 602 and Northeast (N.E.) 912, respectively. The plant populations at harvest were approximately 28,400 and 42,500 plants per hectare. These silages were grown in replicated plots and were harvested as near

as possible to 25 and 35% dry matter. In addition to the eight silages, an intermediate silage was harvested to be fed throughout all trials as a control silage. This control silage was a medium maturing variety (Todd 635), planted at a rate of 33,350 plants per hectare, and harvested at about 30% dry matter. In the fall of 1964, the silages were harvested and directly ensiled in three conventional 3-meter diameter silos. One silo received the control silage and the remaining eight treatments were divided into the other two silos (table I) with all low-dry-matter silages stored in one silo and all high-dry-matter silages in the other. The four equal layers were separated by polyethylene sheets.

Intake trials. Twelve Holstein steers and six heifers were blocked according to weight and sex and assigned to one of six replicates (blocks) of three animals each. The steers which were assigned to four replicates varied in body weight from 123 to 281 kg. at the start of the experiment. The six heifers which were uniform in body weight were assigned to one of two replicates, one to receive 454 gm. of soybean meal per day throughout the experiment and the other to receive no soybean meal. All animals had access to trace mineralized salt and steamed bonemeal.

Animals from each replicate were randomly assigned to the control silage and to two other silages which were fed during the same period. The experiment consisted of four feeding periods (table I). The silages were fed *ad libitum* (approximately 10% in excess of intake) for a 14-day preliminary period and the following 7-day period was used to obtain voluntary intake values. The animals were weighed on the 3rd and 6th day of the week when voluntary intake values were obtained.

Representative silage samples were taken daily for dry matter determination during the week that voluntary intake was measured. The voluntary intakes were compared among treatments on the basis of intake as a percent of bodyweight ($W^{1.0}$) and metabolic weight ($W^{0.75}$).

Digestion trials. The nine Holstein steers from the three replicates of smaller steers used in the intake trials were used in the digestion trial following the intake trial. The digestion trial consisted of a 7-day preliminary period followed by a 7-day period of total collection of feces and urine. The animals were put in metabolism crates 3 days prior to the collection period. Intake during the digestion trial was limited to 85% of voluntary intake as determined in the intake study. Daily samples of feces were taken and composited; one was dried for energy and dry-matter determinations; the other was frozen for nitrogen analysis. Daily samples of silage were composited and analyzed for energy, nitrogen and dry matter.

Chemical and statistical analysis. Dry matter was determined by toluene distillation. Nitrogen in silage, feces and urine was determined by the Kjeldahl method (A. O. A. C., 1960) on non-dried samples. An adiabatic Parr bomb calorimeter was used to determine gross energy content of the dried samples of silage and feces.

The study was designed to eliminate period differences (E. L. Cox, personal communication) by using a control silage throughout the experiment. Within each period the control silage was used to measure responses as a deviation between the treatment silage observations and the average control silage values. The control silage was not considered as one of the treatments but was used only to derive the measurement of response. These observations (expressed as deviations) of the 8 silages were then used in an analysis of variance for a 2X2X2 factorial arrangement in a randomized block design.

Experiment II

Silages. The corn silage varieties were the same as used in Experiment I, however, they were planted at different rates and harvested at different moisture contents. The plant populations at harvest were 36,200 and 44,900 plants per hectare for the Northeast 912, and 42,500 and 51,900 for the Pennsylvania 602. Both varieties were harvested at about 30 and 45% moisture content. The control

silage (Todd 635) had a plant population of 45,500 and was harvested with a dry matter content of 40%.

Intake trials. Twelve Holstein steers were assigned to replicates on the basis of bodyweight, nine smaller steers (191 to 245 kg. bodyweight) and three larger steers (284 to 333 kg. average bodyweight). All steers received 454 gm. of soybean meal per day during the entire experiment. In all other aspects the intake trials were conducted as in Experiment I.

Digestion trials. The nine smaller Holstein steers used in the intake trial were used for the digestion trials. The same procedures were followed in this experiment as in Experiment I, with the following exception: urine was not collected, therefore, a nitrogen balance was not calculated.

In calculating the digestibility of the nutrients in the silage, corrections were made for the contribution of soybean meal to the feces by subtracting the calculated undigestible portion of soybean meal in the feces. Morrison's (1956) digestion coefficients for dry matter of soybean meal were used to determine the fraction of the soybean meal contained in the feces. The energy contained in the feces was calculated by determining the gross energy of soybean meal on an adiabatic Parr bomb calorimeter and basing the digestible energy on a TDN value from Morrison (1956). The value of 2,000 calories was considered equal to 454 grams of TDN, as suggested by Swift (1957). The soybean meal nitrogen content was determined by the Kjeldahl method and the digestion coefficients of protein were obtained from Morrison (1956).

Chemical and statistical analysis. All analyses and determinations were as described in Experiment I with the addition of pH determinations of the silages which were made with a Beckman pH meter.

The statistical analysis applied was as described in Experiment I.

Results and Discussion

Plot yields are shown in table II. Yields increased with later harvests

in the first experiment. In the second experiment the silages were harvested at a higher dry matter content and the yields did not consistently show an increase with later harvests. Differences in yield due to plant population were not consistent. Northeast 912 variety yielded slightly more silage both years.

Experiment I.

Daily dry matter intake of the corn silages expressed as a percent of bodyweight indicates that there were significant differences due to plant population and variety (table V). The higher population corn silages had a higher ($P < 0.01$) intake on the percent bodyweight and metabolic weight basis than did the low population corn silages. Althought the high dry matter silages (average 35.4%) consistently resulted in higher intakes than the low dry matter silages (average 24.6%) in three out of the four feeding periods (table IV), the difference was not statistically significant.

The intake values of this experiment were determined with four steers and two heifers for each silage. Half of the heifers used in Experiment I received soybean meal (454 gm. daily) throughout the experiment to test the effect of protein supplementation on intake and growth. The heifers receiving the protein supplementation had an average daily dry matter intake of 1.83% of bodyweight compared to 1.67% for the non-supplemented group. On the basis of intake per unit metabolic body size the differences were significant ($P < 0.01$). The protein supplemented heifers also gained weight at a greater rate; 458 gm. per day compared to 177 gm. per day for the non-supplemented group.

Average dry matter digestion coefficients are shown in table IV and V. With the low dry matter silages an average digestion coefficient of 67.8% was obtained, which was greater ($P < 0.01$) than the 60.0% for the high dry matter silages. The low dry matter silages consistently had higher dry matter digestibilities than the high dry matter silages, but the control (31.0% dry matter) silage varied more and was not significantly different from the low and high dry matter silages. The energy digestion coefficient differences were, with

a few exceptions, of the same magnitude and statistical differences as the dry matter digestion coefficients (table IV and V). The energy digestibility of low and high population corn silages was statistically different ($P < 0.05$).

Digestible protein and nitrogen balance (table IV and V) indicate the probable deficiency of protein in the diet. As shown in table IV the average protein digestion coefficient for each period decreased from Period I through Period IV. The same trend is shown by nitrogen balance values. The general body condition of the steers declined as the experiment progressed and appeared to parallel the decrease in protein digestion. In Period IV, the high dry matter silage showed a negative nitrogen balance and a calculated negative protein digestion coefficient. The growth rate of the nine steers used for the 166-day experiment was minus 136 gm. daily.

Experiment II.

Results of this experiment showed no significant difference in voluntary intake values between corn silages (table VII). The intakes in this experiment were greater than in Experiment I, which may be due to protein supplementation, or the use of larger animals which have low protein requirements per unit of bodyweight. Steers were used and all received protein supplementation (454 gm. of soybean meal per day). In this experiment the silages ensiled at a low dry matter content (average 29.8%) resulted in a dry matter digestion coefficient of 67.8 percent, which was greater ($P < 0.05$) than the high dry matter silages (average 45.2%) which had a coefficient of 65.3% (table VII). Data in table VI show the high dry matter silage was consistently less digestible. However, the control silage which was medium in dry matter content did not fall into a consistent pattern in relation to the low and high dry matter silages. Low population silage appeared more ($P < 0.05$) digestible than high population silage. No differences in digestible dry matter were observed due to variety. Energy digestion coefficients were similar to dry matter coefficients except that energy digestion coefficient differences were not statistically different. Protein digestion

coefficient differences were observed due to maturity and variety (table VII). The protein of low dry matter silage was ($P < 0.05$) more digestible than that of high dry matter silage. Looking at the feeding periods individually, one notes that Period I is the only period that the high dry matter silage protein was more digestible. Corn silages of the Pennsylvania 602 variety had higher ($P < 0.05$) protein digestion coefficients than the Northeast 912 variety.

Discussion.

The crude protein content of the various treatments (table III) was similar in both experiments. Pennsylvania 602 silages consistently had the highest crude protein content. The planting rate and dry matter percent at ensiling had no effect on the crude protein content. The pH as determined in the second experiment did not show any significant difference ($P < 0.10$) although there was a tendency to be higher in the high dry matter silages.

Treatment effects on intake could not be attributed to dry matter at ensiling. Differences were small when compared to those reported by Huber _et al_. (1965) who found intakes of corn silage to increase significantly as the stage of maturity increased. They used lactating cows rather than young growing animals which were used in these experiments. The reason for this difference may be the stimulative effect of lactation on intake as demonstrated by Buchman and Hemken (1964). Ward _et al_. (1966) using both beef calves and dairy cows observed a positive relationship between dry matter percent and intake in sorghum silages. Gordon _et al_. (1965) studied the effect of wilted alfalfa silages with dry matter contents ranging from 39 to 65% and found the intake to increase significantly with increases in the dry matter content of the silages using milking cows.

Digestibility data indicated a gradual decline in digestibility with increasing dry matter content. Since the gross energy was determined on dried samples, the differences in energy digestion could be greater than indicated if one assumes a greater content of volatiles are present in the low dry matter silage then in the high dry matter silage. Huber _et al_. (1965) observed no

differences in digestibility in feeding corn silages of varying dry matter content. Results of these experiments would suggest that decreased in digestibility due to increasing dry matter content are of very low magnitude and very gradual change. Byers and Ormiston (1964) compared 31.5% dry matter corn silage to 54.9% dry matter corn silage and found that the high dry matter silage was significantly less digestible. The reason for the magnitude of difference being less in Experiment II could be attributed to the apparent protein deficient diet used in Experiment I. Differences in energy digestion due to plant population was similar in both experiments but the magnitude was very small. The difference between Northeast 912 (fed in the first two feeding periods) and Pennsylvania 602 (fed in the last two feeding periods) in the first experiment follows the trend of decreasing digestibility from feeding Period I to IV. The performance of the steers in the first experiment seemed to indicate that corn silage was not furnishing enough protein for maintenance. This was evident in the loss of weight of the steers as the experiment progressed. From this experiment it would appear that animals being fed only corn silage for intake and digestion studies need protein supplementation. This may be true only in the case of smaller animals because the steers that lost weight weighed less than 170 kg. at the start of the experiment while the larger steers did not. Looking at the different feeding periods of the first experiment (table V) one finds a progressive decrease in average digestibility from Period I to Period IV. This suggests Experiment I cannot be compared to Experiment II results.

Protein digestibility tended to be lower in high dry matter silages although differences due to dry matter only were significant in the second experiment. Since the protein content was similar for both high and low dry matter silages, a decline in protein digestibility would not be expected based on standard regression formulas of digestible protein in forages and the crude protein content of forages (Holter and Reid, 1959). The lack of statistical significance in the first experiment is the result of an extremely high variation in results. Huber et al. (1965) feeding corn ensiled at different stages of maturity, found no relationship

of silage dry matter to digestible protein. Higher plant populations resulted in decreased protein digestibility in both experiments, however, this difference was not significant. Alexander et al. (1963) compared 16,680 to 33,360 plants per hectare. Protein content was reduced from 7.2 to 6.0% and protein digestibility from 56 to 49% by increasing plant population. But in our experiments there was no change in crude protein content due to plant density. This apparently is an effect of the fertility level of the soil. If the nitrogen content of the soil is relatively high, then a change in crude protein content of the corn silage would not be expected with an increase in plant density. Apparently Alexander et al. (1963) grew their corn on a soil of lower nitrogen fertility.

Variety Pennsylvania 602 had higher protein digestion coefficients (table VII) than the Northeast 912 corn variety in the second experiment. This would be expected since the Pennsylvania 602 variety had a higher crude protein content in both experiments. In the statistical analysis of the data, none of the interactions between variables were statistically significant. Therefore, it could be concluded that the variables studied in this experiment do not interact and the differences observed would be additive.

Summary

Intake and digestibilities or corn silages of early and late maturing varieties which were grown in low and high plant populations and ensiled at low and high dry matter contents were studied with Holstein steers.

The silage dry matter ranged from 23.0% to 47.8%. No consistent difference occurred in intakes due to treatment. Dry matter and energy digestibilities were greater ($P < 0.05$) for the low dry matter silages. Low population corn silages had greater ($P < 0.05$) energy digestion coefficients. Protein digestion was consistently less for the high dry matter silages.

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TABLE I. SILAGE PLACEMENT WITHIN SILOS AND CORRESPONDING FEEDING PERIODS

Feeding period	Silo I	Silo II	Silo III
Period I	N. E. 912	Todd 635	N. E. 912
Expt. I	34.6; 39,550[a]	31.0; 33,350	25.3; 28,400
Expt. II	43.2; 36,200	40.0; 45,450	33.2; 36,200
Period II	N. E. 912	Todd 635	N. E. 912
Expt. I	34.5; 28,400	31.0; 33,350	25.1; 39,550
Expt. II	47.8; 44,900	40.0; 45,450	31.0; 44,900
Period III	Pa. 602	Todd 635	Pa. 602
Expt. I	35.7; 28,400	31.0; 33,350	23.0; 28,400
Expt. II	44.6; 42,500	40.0; 45,450	28.1; 42,500
Period IV	Pa. 602	Todd 635	Pa. 602
Expt. I	36.7; 39,550	31.0; 33,350	24.9; 39,550
Expt. II	45.0; 51,900	40.0; 45,450	27.8; 51,900

[a] Dry matter content and plants per hectare, respectively.

TABLE II. HARVESTING DATES AND DRY MATTER YIELDS OF SILAGE

Variety	Population per hectare	Harvest dates	Dry matter, %	Dry Weight, Metric Ton/Hectare
1964 (Experiment I)[a]				
Pa. 602	39,600	Aug. 26	24.9	11.0
Pa. 602	28,400	Aug. 26	23.0	10.1
Pa. 602	39,550	Sept. 10	36.7	12.1
Pa. 602	28,400	Sept. 10	35.7	12.8
Todd 635	33,350	Sept. 8	31.0	11.7
N. E. 912	39,550	Sept. 4	25.1	11.9
N. E. 912	28,400	Sept. 4	25.3	11.2
N. E. 912	39,550	Sept. 15	34.6	13.9
N. E. 912	28,400	Sept. 15	34.5	12.6
1965 (Experiment II)[b]				
Pa. 602	51,900	Sept. 3	27.8	11.7
Pa. 602	42,500	Sept. 7	28.1	10.5
Pa. 602	51,900	Sept. 22	45.0	12.3
Pa. 602	42,500	Sept. 23	44.6	10.8
Todd 635	45,450	Sept. 24	40.0	13.7
N. E. 912	44,900	Sept. 20	31.0	13.2
N. E. 912	36,200	Sept. 21	33.2	15.9
N. E. 912	44,900	Oct. 11	47.8	16.8
N. E. 912	36,200	Oct. 13	43.2	14.3

[a] Planting date: May 26

[b] Planting date: May 20

TABLE III. AVERAGE CRUDE PROTEIN PERCENT AND pH OF SILAGES ACCORDING TO TREATMENT GROUP

Treatment	Experiment I	Experiment II	
	Crude protein	Crude protein	pH
	(%)	(%)	
Control silage[a]	8.39	7.83	4.13
Variety			
N. E. 912	7.82	7.74	4.21
Pa. 602	9.23	8.29	3.84
Plant population			
High	8.48	7.97	4.11
Low	8.57	8.06	3.94
Dry matter at ensiling			
Low	8.56	7.99	3.76
High	8.49	8.05	4.29

[a] Todd 635, medium plant population, and medium dry matter content.

TABLE IV. THE AVERAGE DAILY INTAKE AND DIGESTION COEFFICIENTS FOR CORN SILAGES FED BY PERIOD IN EXPERIMENT I

Period and variety	Planting rate[a] and dry matter at ensiling	Intake/$W^{1.0}$	Intake/$W^{.75}$	Dry matter digestion	Energy digestion	Protein digestion	Nitrogen balance
		(%)	(%)	(%)	(%)	(%)	(gm./day)
Period I							
N. E. 912	Low rate - 25.3%	1.74	6.37	70.9	70.2	32.6	12.0
N. E. 912	High rate - 34.6%	1.90	6.98	69.6	67.9	52.0	14.6
Todd 635[b]	Medium rate - 31.0%	1.84	6.75	66.1	64.6	47.8	12.1
Period II							
N. E. 912	High rate - 25.1%	1.81	6.74	65.6	64.0	38.1	12.9
N. E. 912	Low rate - 34.5%	1.49	5.58	62.5	60.4	31.7	8.1
Todd 635	Medium rate - 31.0%	1.73	6.46	66.3	64.6	44.8	13.0
Period III							
Pa. 602	Low rate - 23.0%	1.75	6.65	71.5	70.6	48.3	19.9
Pa. 602	Low rate - 35.7%	1.93	7.29	53.3	51.3	13.2	3.3
Todd 635	Medium rate - 31.0%	1.95	7.39	62.0	60.2	8.5	3.1
Period IV							
Pa. 602	High rate - 24.9%	1.65	6.17	63.0	61.3	17.2	3.7
Pa. 602	High rate - 36.7%	1.85	7.04	54.2	51.4	-8.0	-3.2
Todd 635	Medium rate - 31.0%	1.45	5.49	63.9	61.5	16.1	6.8

[a] The plants per hectare were 28,400, 33,350 and 39,550 for low, medium and high rates, respectively. These are referred to as low and high for Pa. 602 and N. E. 912 and medium for Todd 635.

[b] Control silage.

TABLE V. THE AVERAGE DAILY INTAKE AND DIGESTION COEFFICIENTS FOR CORN SILAGES BY TREATMENTS IN EXPERIMENT I

Treatment	Intake/$W^{1.0}$	Intake/$W^{.75}$	Dry matter digestion	Energy digestion	Crude protein digestion	Nitrogen balance
	(%)	(%)	(%)	(%)	(%)	(gm./day)
<u>Control silage</u>[e]	1.74	6.52	64.6	62.7	29.3	8.7
<u>Variety</u>						
N. E. 912	1.74[b]	6.42	67.2[a]	65.6[a]	38.6	11.9
Pa. 602	1.80[a]	6.79	60.5[b]	58.7[b]	17.7	5.9
<u>Plant population</u>						
High	1.80[c]	6.73[c]	63.1	61.2[b]	24.8	7.0
Low	1.73[d]	6.48[d]	64.6	63.1[a]	31.4	10.8
<u>Dry matter at ensiling</u>						
Low	1.74	6.49	67.8[c]	66.5[c]	34.0	12.1
High	1.79	6.72	60.0[d]	57.8[d]	22.2	5.7

a,b Values are significantly different, $P < 0.05$.

c,d Values are significantly different, $P < 0.01$.

e Todd 635, medium plant population and medium dry matter content.

TABLE VI. THE AVERAGE DAILY INTAKE AND DIGESTION COEFFICIENTS FOR CORN SILAGES FED BY PERIOD IN EXPERIMENT II

Period and variety	Planting rate[a] and dry matter at ensiling	Intake/$W^{1.0}$	Intake/$W^{.75}$	Dry matter digestion	Energy digestion	Protein digestion
		(%)	(%)	(%)	(%)	(%)
Period 1						
N. E. 912	Low rate - 33.2%	2.23	8.74	68.5	68.5	40.5
N. E. 912	Low rate - 43.2%	2.24	8.86	65.4	65.6	43.5
Todd 635[b]	Medium rate - 40.0%	2.25	8.92	68.5	68.9	47.1
Period II						
N. E. 912	High rate - 31.0%	1.85	7.38	65.9	65.6	47.0
N. E. 912	High rate - 47.8%	1.95	8.02	61.5	62.8	35.7
Todd 635	Medium rate - 40.0%	2.18	8.96	63.4	62.9	41.1
Period III						
Pa. 602	Low rate - 28.1%	2.03	8.56	67.4	67.3	50.9
Pa. 602	Low rate - 44.6%	1.89	7.87	67.1	67.1	49.3
Todd 635	Medium rate - 40.0%	1.99	8.38	68.8	67.7	46.7
Period IV						
Pa. 602	High rate - 27.8%	1.88	8.12	69.3	68.9	48.1
Pa. 602	High rate - 45.0%	2.21	9.52	67.0	66.3	43.3
Todd 635	Medium rate - 40.0%	2.14	9.00	66.5	66.2	46.1

[a] The plants per hectare were 42,500 and 51,900 for Pa. 602; 45,500 for Todd 635; and 36,200 and 44,900 for N. E. 912.

[b] Control silage.

TABLE VII. THE AVERAGE DAILY INTAKE AND DIGESTION COEFFICIENTS FOR CORN SILAGE BY TREATMENTS IN EXPERIMENT II

Treatment	Intake/$W^{1.0}$	Intake/$W^{.75}$	Dry matter digestion	Energy digestion	Crude protein digestion
Control silage[c]	2.14	8.82	66.8	66.4	45.3
Variety					
N. E. 912	2.07	8.25	65.3	65.6	41.7[b]
Pa. 602	2.00	8.51	67.7	67.4	47.9[a]
Plant population					
High	1.97	8.26	65.9[b]	65.9[b]	43.5
Low	2.10	8.51	67.1[a]	67.1[a]	46.1
Dry matter at ensiling					
Low	2.00	8.20	67.8[a]	67.6	46.6[a]
High	2.07	8.57	65.3[b]	65.5	42.9[b]

a,b Values are significantly different, $P < 0.05$.

c Todd 635, medium plant population and medium dry matter content.

NUTRITIVE VALUE OF CORN SILAGES AS INFLUENCED BY THE EAR: STALK RATIO

R.W. Hemken, J.H. Vandersall, N.A. Clark, and H.K. Goering

University of Maryland, College Park

The work reported from the first two years of study demonstrated only small differences due to planting rate, plant population, and varieties with different lengths of growing seasons. Based on reports from other stations as well as the results of our earlier trials, the dry matter at ensiling time is the primary influence on the dry matter intake of animals.

The purpose of the last two years was to determine the effect of extreme ranges in ear: stalk ratios on the nutritive value of corn silage.

Experimental

Experiment III

Silages. Six silages were stored in silos in amounts to allow for intake and digestibility studies of four silages during each of two trials. The silage treatments used during the trials were:

Trial I

(1) Dekalb XL45, grown with 32,300 plants per acre, and harvested at 49.4% dry matter.

(2) Pioneer 1097, grown with 43,900 plants per acre, and harvested at 36.8% dry matter.

(3) Pioneer 1097, grown with 21,250 plants per acre, and harvested at 22.1% dry matter.

(4) Pioneer 1097, grown with 21,250 plants per acre, and harvested at 45.0% dry matter.

Trial II

(1) Dekalb XL45, grown with 32,300 plants per acre, and harvested at 26.4% dry matter.

(2) Pioneer 1097, grown with 43,900 plants per acre, and harvested at 20.5% dry matter.

(3) Same as Trial I (3)

(4) Same as Trial I (4)

The Dekalb XL45 was selected because it represents a variety with a very high percentage of ears and Pioneer 1097 represents a variety with a very low percentage of ears.

Intake trials. In a randomized block design, eight Holstein steers were randomly assigned to the four silages for Period I and again were randomly assigned to the same four silages for Period II. Therefore, each intake value represents the average intake rate of four animals. All animals were fed one pound of soybean meal once each day. The silages were fed *ad libitum* (approximately 10% in excess of intake) for a 14-day preliminary period and the following 7-day period was used to obtain voluntary intake values. The animals were weighed on the 3rd and 6th day of the week when voluntary intake values were obtained. All steers had free access to trace mineralized salt and dicalcium phosphate.

Six lactating Holstein cows were also assigned to a similar randomized block design and followed through the same procedures used with the steers. They were changed to the next treatment at the conclusion of the intake period rather than continuing on with digestion trials.

Representative silage samples were taken daily for dry matter determinations during the week voluntary intake was measured. The voluntary intakes were calculated on the basis of intake as percent of bodyweight ($W^{1.0}$) and metabolic bodyweight ($W^{0.75}$).

Digestion trials. The same steers were used for the digestibility determinations as used for the intake part of the study. The digestion trial consisted of a 7-day preliminary period followed by a 7-day period of total collection of feces. Intake of silage was limited to 85% of voluntary intake as determined in the intake study. The animals were put in metabolism crates 3 days prior to the collection period. The one-pound of soybean meal was continued throughout this period. Daily samples of feces were taken and composited; one was dried for energy and dry-matter determinations; the other was frozen for other analysis.

Chemical and statistical analysis. Dry matter was determined by toluene distillation. Nitrogen in the silage and feces were determined by the Kjeldahl method (A. O. A. C., 1960) on non-dried samples. An adiabatic Parr bomb calorimeter was used to determine gross energy content of the dried samples of silage and feces. Other determinations were by methods as outlined by Van Soest.

The data were analyzed statistically as outlined by Snedecor.

Experiment IV

Silages. Four corn silages were stored in silos which represent the following treatments:

(1) Pioneer 1097, harvested with 32.6% dry matter.

(2) Pioneer 1097, harvested at the same stage as (1), however, the ears were removed by hand before harvesting.

(3) Dekalb XL45, harvested at 35.1% dry matter.

(4) Dekalb XL45, harvested at the same stage as (3), however, the ears were removed by hand before harvesting.

Intake trials. Intake trials with steers were conducted on the four treatments using the same procedures with two periods as described in Experiment III. One change was the division of the eight steers into two groups. Half of the steers received one pound of soybean meal as used previously and the others received no additional energy or protein supplement.

Digestion trials. The same procedure as described in Experiment III were followed with the exception that half of the steers did not receive soybean meal.

Lactation study. Sixteen cows were randomly assigned to the four silages and were fed grain at either 100% or 120% of their estimated requirements for milk production plus 100% of their estimated maintenance requirements. Therefore, the design of the study was a 2X2X2 factorial design with two varieties, with or without ears, and supplemented with either 100 or 120% of milk production requirements. All animals were fed a control silage for three weeks prior to the start of the experiment and the final week of the three week period was used as a convariate for a covariance statistical analysis of data as well as for

establishing a level of grain supplementation.

The concentrate mix used consisted of 35% ground shelled corn, 40% ground barley, 23% soybean meal, 1% salt, and 1% dicalcium phosphate.

Silage was fed ad libitum and samples were obtained weekly for dry dry matter determinations. Silage was fed three times per day and concentrates were fed two times per day. All cows were weighed for three consecutive days at the start and end of the trial. One-day composite milk samples were taken for milk fat and solids-not-fat determinations.

Chemical and statistical analysis. The same chemical techniques as described in Experiment III were followed. The data were analyzed statistically as outlined by Snedecor.

Results and Discussion

The corn plant and silage composition from Experiment I are presented in Table I. The dry matter at harvest was not quite what had been desired because plans were to harvest each planting rate at about 45% dry matter and at 25% dry matter. The reason for the higher protein content of the Pioneer 1097 with the high planting rate is not clear, however, the difference was consistent. The other differences in the chemical composition were not very great and not as consistent.

The intake and digestibility coefficients for the silages as presented in Table II show very few differences. While the Dekalb XL45 would be expected to have a higher energy and dry matter digestion coefficients, the results with the mature harvest were lower than average and the results from the early harvest were a little higher than average. Since the Dekalb had almost twice the ear content of the Pioneer 1097, it has been suggested that it should provide more energy per unit of weight. The results show a trend for slightly lower digestion coefffficients as the corn matures, however, the differences are small and not always significant.

In both trials the protein digestibility was lower for the Dekalb XL45 than for the Pioneer 1097. As shown on the table, there were some statistically significant differences, however, they generally reflect small differences rather than major changes.

The effect of removing the ears from the two varieties on chemical composition is shown in Table III. The fibrous fractions are all increased when the ears are removed once the dry matter content is reduced.

The dry matter losses due to ensiling, as estimated by the "hidden bag" technique, were 14.9% ± 13.6 for Dekalb XL45 harvested with ears, 3.6% ± 5.8

for Dekalb XL45 harvested without ears, 5.2% ± 4.8 for Pioneer 1097 harvested with ears, and 0.0% ± 10.1 for Pioneer 1097 harvested without ears. None of these differences were significant.

The changes in digestibility of nutrients (Table IV) produced most of the changes that would be expected by removing ears. The differences due to variety are small and support the results of Experiment III that varieties which differ widely in ear: stalk ratio do not have large differences in digestible energy. The statistical differences are presented in Table V.

Soybean meal did not change any digestion coefficient signigicantly, however, there did appear to be some consistent changes which would indicate a small improvement in the digestibility of some fractions. In contrast to the results obtained in Experiment I (Goering, et al.), intake of dry matter was not increased (Table VI) with soybean meal supplementation. Older animals were used during this study which may explain the different response.

Dry matter intake was lowered when the ears were removed for both the steers (Table VI) and with lactating cows (Table VII). A large part of this effect could be due to the lower dry matter content which has been shown to effect intake. The effect of variety was not significant.

Performance of the lactating cows reflected the dry matter intake of the silage even though an attempt had been made to level out intake by increasing grain intake of the cows receiving earless corn silage. As shown in the bottom of Table VII, the additional grain at both the 100% and 120% level resulted in lower bodyweight gains. Most of the differences in energy intake appears to show up in changes in bodyweight rather than changes in milk production.

The apparent lack of significant differences between Dekalb XL45 and Pioneer 1097 raises a question as to the validity of some recommendations concerning varieties to use for corn silage. If the enrichment in the energy value due to ears would result in significant improvement in production of dairy cows, a variety like XL45 should be used. However, the results of these trials suggest that tonage per acre may be a more important criteria for the selection of a corn variety rather than the ear: stalk ratio.

TABLE I. EXPERIMENT III - CORN PLANT AND SILAGE COMPOSITION (DRY BASIS)

		Dry Matter		Protein		Cell Walls		ADF		Lignin	
Variety	Plants/Acre	Fresh %	Silage %	Fresh %	Silage %	Fresh %	Silage %	Fresh %	Silage %	Fresh %	Silage %
Trial I											
Dekalb XL45	32,300	49.4	49.8	9.29	9.80	42.2	46.9	23.6	24.5	2.7	3.4
Pioneer 1097	43,900	36.8	37.4	10.19	10.78	53.7	53.8	23.3	31.7	3.0	3.7
Pioneer 1097	21,250	22.1	25.2	9.35	9.76	48.5	48.8	26.2	26.6	2.5	3.1
Pioneer 1097	21,250	45.0	46.0	9.22	9.64	56.2	47.2	27.5	27.7	2.8	3.4
Trial II											
Dekalb XL45	32,300	26.4	27.2	9.60	9.32	46.9	45.6	24.9	24.7	2.3	2.5
Pioneer 1097	43,900	20.5	23.3	10.85	10.99	49.8	51.8	27.9	29.9	2.4	3.1
Pioneer 1097	21,250	22.1	26.0	9.66	9.64	47.2	46.7	25.6	27.3	2.3	3.0
Pioneer 1097	21,250	45.0	44.1	9.38	9.76	50.3	47.4	25.6	26.0	2.6	3.0

TABLE II. EXPERIMENT IV - INTAKE AND DIGESTIBILITY OF CORN SILAGE

			Intake-% Of Body Weight		Intake per Metabolic B.W.		Digestion Coefficients(3)				
Variety	Plants/Acre	Silage D.M.	Steers(1)	Cows(2)	Steers	Cows	D.M.	Energy	Protein	Cell Walls	ADF
Trial I											
Dekalb XL45	32,300	49.8	2.25	1.88	9.36	9.19	64.5(4)	65.2(4)	40.7(4)	59.2	56.6
Pioneer 1097	43,900	37.4	2.14	1.54	8.98	7.63	63.3	63.7	49.0	62.4	59.1
Pioneer 1097	21,250	25.2	2.11	1.73	8.81	8.41	67.0	67.2	50.7	61.2	55.9
Pioneer 1097	21,250	46.0	2.26	1.71	9.57	8.37	67.6	67.0	48.4	59.5	61.2
Trial II											
Dekalb XL45	32,300	27.2	2.10(5)	1.91	9.26(5)	9.28	69.3	69.6	42.8(6)	65.1	60.5
Pioneer 1097	43,900	23.3	1.94	1.93	8.43	9.44	67.6	67.8	56.2	65.3	61.8
Pioneer 1097	21,250	26.0	2.08	1.87	9.10	9.17	67.0	68.3	55.4	58.4	56.8
Pioneer 1097	21,250	44.1	2.15	1.81	9.36	8.89	66.7	66.6	50.9	61.2	51.4

(1) Six steers per silage.
(2) Four cows per silage.
(3) Four steers per silage.
(4) Trial difference significant ($P > .10\%$).
(5) Trial difference significant ($P > 5\%$).
(6) Trial difference significant ($P > 2\frac{1}{2}\%$).

TABLE III. SILAGE COMPOSITION FOR EXPERIMENT IV

	Silage Treatment			
	Pioneer 1097		Dekalb XL-45	
	With ears	Without ears	With ears	Without ears
Dry Matter	32.6	24.1	35.1	23.8
Crude Protein	7.8	6.7	7.8	6.8
ADF	27.4	41.0	21.8	41.6
NDF	46.9	63.6	39.2	65.0
Cellulose	22.1	33.3	17.7	33.8
Lignin	4.4	6.3	3.6	5.9

TABLE IV. DIGESTION COEFFICIENTS FOR EXPERIMENT IV

Digestion Coefficient	Silage Treatment					Supplementation		
	Pioneer 1097		Dekalb XL-45		Standard error of Mean	1 lb. Soybean Meal	No Soybean Meal	Standard error of Mean
	With ears	Without ears	With ears	Without ears				
Dry Matter	66.0	56.8	68.8	59.0	1.16	63.6	61.8	0.82
Energy	65.2	56.8	67.9	59.0	1.16	63.3	61.2	0.82
Crude Protein	43.8	32.3	43.5	30.8	2.25	36.8	38.4	1.59
ADF	47.2	51.5	48.3	58.2	1.82	52.4	50.2	1.29
NDF	51.9	53.7	50.5	59.4	1.70	54.8	53.0	1.20
Cellulose	58.7	63.1	57.4	68.9	1.07	63.0	61.1	0.83
Lignin	6.4	8.2	20.1	18.2	3.69	15.5	11.0	2.61

TABLE V. ANALYSIS OF VARIANCE FOR DIGESTION COEFFICIENTS (EXPT. IV)

Source	d.	f.	Mean Squares						
			Dry Matter	Energy	Crude Protein	ADF	NDF	Cellulose	Lignin
Silo	3		129.5^{a}	106.7^{a}	196.7^{a}	97.4^{a}	60.9^{b}	107.0^{a}	192.8^{d}
Variety		1	24.3^{d}	24.0^{d}	3.1	61.2^{d}	18.9	20.7^{d}	564.1^{b}
Ear Content		1	363.9^{a}	295.8^{a}	585.6^{a}	199.5^{a}	113.4^{b}	251.2^{a}	0.0
Interaction		1	0.5	0.3	1.3	31.6	50.4^{d}	49.0^{b}	14.4
Soybean Meal	1		13.1	17.6	10.9	18.3	13.7	14.8	82.8
Period	1		5.9	5.1	26.5	0.6	3.1	0.1	18.1
Error	9		5.9	5.4	20.3	13.3	11.5	5.5	54.4

a = $P < 0.01$ b = $P < 0.025$ c = $P < 0.05$ d = $P < 0.10$

TABLE VI. DRY MATTER INTAKES WITH STEERS (EXPT. IV)

Dry Matter Intake	Silage Treatment					Supplementation		
	Pioneer 1097		Dekalb XL-45		Standard error of Mean	1 lb. Soybean Meal	No Soybean Meal	Standard error of Mean
	With ears	Without ears	With ears	Without ears				
% of Body Wt.	2.56	1.90	2.62	1.63	.14[a]	2.20	2.16	.11
Body Wt. $^{.75}$	11.94	8.84	12.49	7.75	.64[a]	10.30	10.21	.45

a = effect of ear content significant ($P < 0.01$).

TABLE VII. MILK PRODUCTION TRIAL WITH CORN VARIETIES WITH AND WITHOUT EARS (EXPT. IV)

Average Daily Values	Silage Treatment: Pioneer 1097, With ears	Pioneer 1097, Without ears	Dekalb XL-45, With ears	Dekalb XL-45, Without ears	Standard Error of Mean
Silage Intake (lbs)	72.9	75.3	76.5	70.5	1.4[a]
Silage Dry Matter Intake (lbs)	23.4	16.9	26.1	16.7	0.8[b]
Concentrate Intake (lbs)	13.6	18.9	13.9	18.9	---
Milk Production (lbs)	36.0	35.2	38.3	35.0	1.0[a]
Butterfat Test (%)	3.71	3.66	3.88	3.84	0.25[a]
Butterfat Production (lbs)	1.31	1.27	1.47	1.35	0.21[a]
Solids-Not-Fat (%)	8.49	8.61	8.60	8.65	0.32[a]
Body Weight Gain (lbs)	0.77	0.36	1.06	0.37	0.16[b,c]

Average Daily Values	Concentrate Level: 100%, With ears	100%, Without ears	120%, With ears	120%, Without ears	Standard Error of Mean
Silage Intake (lbs)	74.1	74.1	75.3	71.6	1.4[a]
Silage Dry Matter Intake (lbs)	24.7	17.1	24.7	16.5	0.8[b]
Concentrate Intake (lbs)	11.2	16.2	16.2	21.6	---
Milk Production (lbs)	37.1	34.2	37.1	36.1	1.0[a]
Butterfat Test (%)	3.68	3.64	3.83	3.85	0.25[a]
Butterfat Production (lbs)	1.34	1.20	1.44	1.42	0.21[a]
Solids-Not-Fat (%)	8.51	8.62	8.58	8.64	0.32[a]
Body Weight Gain (lbs)	0.60	0.17	1.22	0.73	0.16[b,c]

a - no significant differences

b - difference due to ear content significant ($P < 0.01$)

c - difference due to grain level significant ($P < 0.025$)